pected in the closely built-up sections of a city. Temperatures in the shade, 30 feet away, were not influenced by the pavements."

These tests were made in Riverside, Ill., far enough inland to escape the lake breeze and all the pavements were in the same vicinity. Weather conditions were ideal, as the sky was clear, and the air temperatures recorded at Chicago were the highest of the summer.

"For each pavement, readings were taken at the surface, 1 foot and 4 feet above, and 30 feet to one side of the roadway in the shade of a lawn. An additional set of readings was taken 4 feet over grass in the sun. Thirteen standard 25 cm. Fahrenheit thermometers were used, each protected from direct sunlight by a white paper or pasteboard cover. Readings were taken every half hour from 8 a. m. to 10 p. m."

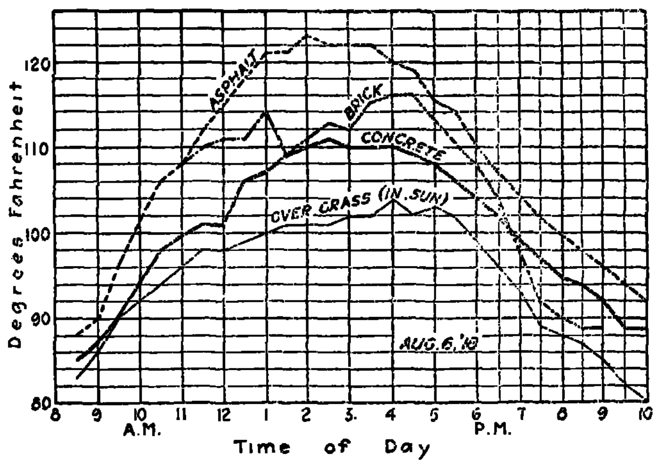

FIG. 1.—Surface temperatures for various types of surfacing.

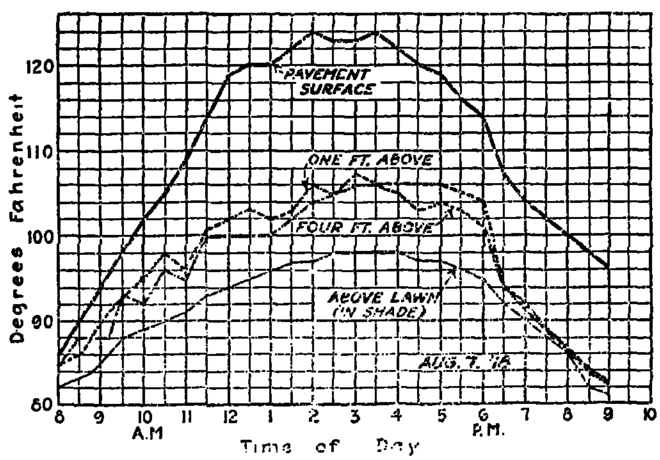

FIG. 2.—Variation between asphalt surfaces and various adjacent locations.

Figures 1 and 2 show sets of readings plotted between temperatures as ordinates and time of day as abcissae. "Figure 1 shows the difference between the various pavement surface temperatures and also the readings over a lawn in the sun. The drop in the brick temperature curve at 1:30 p. m. was due to the moving of the observation station on account of the encroachment of shade. No point could be found on the brick surface that was in the sun for the entire day. The rapid drop in the same curve between 6 and 8 p. m. was probably due to the proximity of the Des Plaines River, as air temperatures taken near showed a similar drop. Figure 2 shows the relation, for an asphalt pavement, between temperatures at the surface, 1 foot above, 4 feet above, and in the shade 30 feet to one side of the roadway."—*C. L. M.*

COMPARISON OF ROAD-SUBGRADE AND AIR TEMPERATURES.

By C. C. WILEY.

[Abstracted from Engineering News-Record, July 17, 1919, pp. 128-129.]

"Investigations were started at the University of Illinois in the belief that some of the phenomena of cracking and heaving of brick and concrete roads can be explained by a study of the range and rate of change in temperatures within the pavement and in the underlying soil. The observations will extend over a considerable period of time to obtain data concerning some of these factors." Preliminary records show that changes in temperature are transferred very slowly from the air to the subsoil, and that the subgrade extremes lag considerably behind those of the air.

"The fact that the changes of temperature at the bottom of the slab are considerably slower and much less in magnitude than those of the air may be worth considering in connection with protecting a new pavement from freezing. Also it may be noted that the change from maximum to minimum temperatures in the slab takes place over a considerable length of time, during which the slab and subgrade have an opportunity to adjust themselves to the changed conditions."—*C. L. M.*

PENETRATION OF PERIODIC TEMPERATURE WAVES INTO THE SOIL.

By K. AICHI.

[Reprinted from Science Abstracts, Sect., A, Mar. 31, 1919, § 240.]

The paper deals in a theoretical manner with the conduction of heat through a substance such as the soil. In working out the annual temperature wave at depths of 1 m., 2 m., and so on from that at the surface it is customary to assume the conductivity and specific heat constant throughout each layer. This is far from being the case, and it is shown that the assumption invalidates the results of such calculations. The ratio of the conductivity to the specific heat can be obtained (1) from the change of amplitude of the temperature wave with depth, and (2) from the retardation of phase, and in certain practical examples to which the formulæ are applied in the customary manner it is found that the results from (1) and (2) are in very poor agreement. In the paper certain cases where the conductivity varies with depth in a specified manner are treated mathematically.—*J. S. Di.*

NEW METHOD OF REDUCTION OF OBSERVATIONS OF UNDERGROUND TEMPERATURE.

By K. AICHI.

[Abstract reprinted from Science Abstracts, Apr. 30, 1919, p. 151. Art. in Phys.-Math. Soc., Japan, Proc. 1 (Ser. 3) pp. 2-7. Jan., 1919.]

A further discussion concerning the passage of the annual temperature wave downward through the soil, where the conductivity K and specific heat C vary with depth, see Abs. 240, 1919. If temperature observations were available at all depths, K and C could be calculated uniquely as functions of the depth, but actually, where observations at certain specified depths only are taken, a definite solution of the problem is not possible. Various methods of calculating the "equivalent diffusivity" of the layer between two points of observation are discussed and numerical examples are worked out.—*J. S. Di.*

TEMPERATURES IN NEW YORK SUBWAYS.

Through the courtesy of Mr. D. L. Turner, Chief Engineer, Transit Construction Commissioner, State of New York, thirteen prints were obtained showing the temperatures in New York subways, 1904–1917. The most interesting two are reproduced as figures 1 and 2.

Figure 1 shows strikingly the effect of operation on the temperature, the temperatures during operation averaging 11° to 20° F. higher than those before operation. Can this be due to the combined effect of human and mechanical heat? Before operation the average temperature, about 54° F. nearly coincides, as would be expected, with the mean annual air temperature of New York, 52° F. The range of the average temperature, 39° to 69° F., is only two-thirds the range of mean monthly air temperature at New York City.

Figure 2 attests to the efficient ventilation of the subways. Cold days outside are cold days in the subways and warm days are warm outside and in. The temperature variability, is, necessarily, less than half as great in the subways as outside.—*C. F. B.*

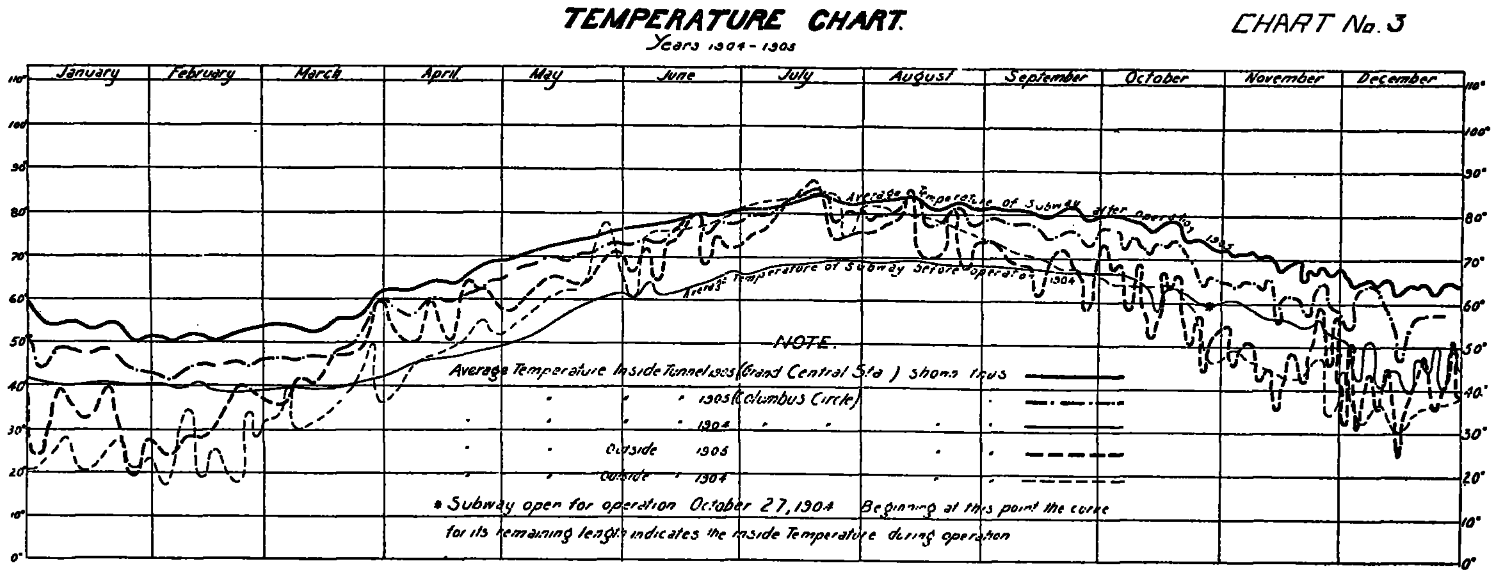

FIG. 1.—This chart is designed to show, in a general way, the relative variations in temperature inside and outside of tunnel for the years 1904 and 1905, with the particular object of showing the changes inside the tunnel resulting from the operation of trains. The thermometer at Columbus Circle is at the south end of west platform, while that at Grand Central Station is about 70 feet west of south-bound-train platform, between south-bound local and express tracks, and gives the approximate average temperature throughout the subway at stations and intermediate points.

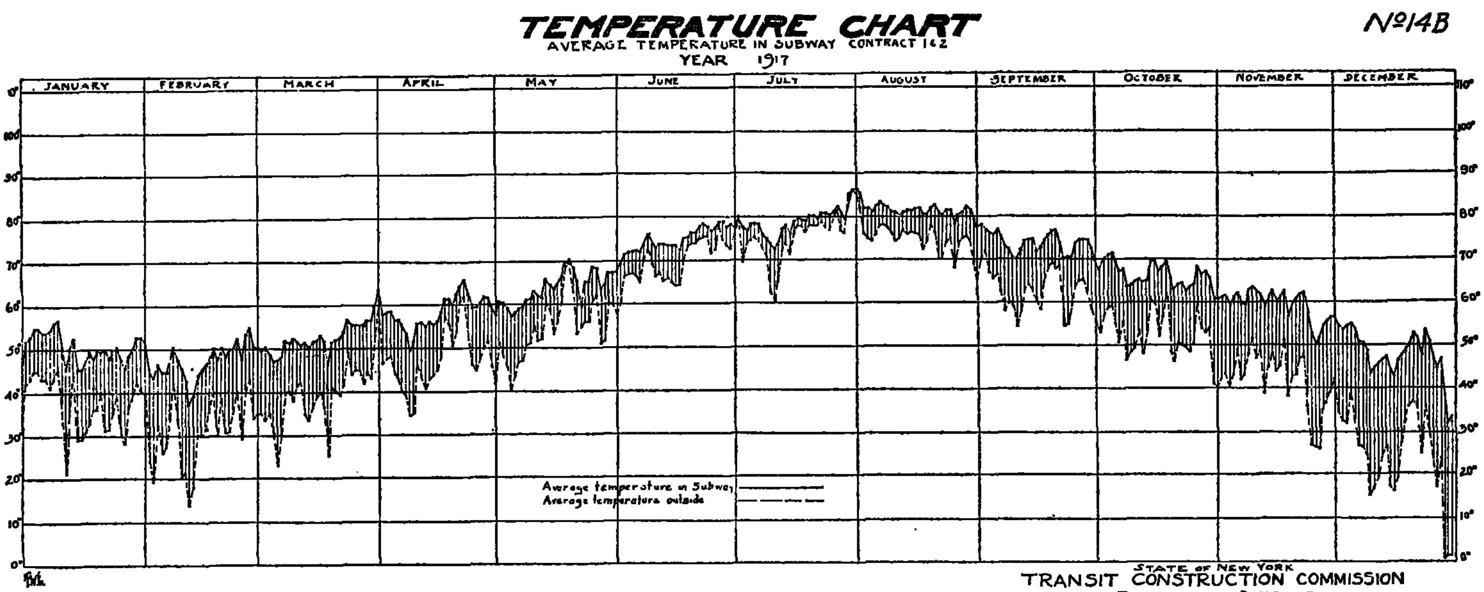

FIG. 2.—Average 1917 daily air temperatures outside and in the Manhattan-Bronx & Brooklyn subways covered by contracts 1 and 2.

AN ICE MINE THAT FREEZES IN SUMMER AND MELTS IN WINTER.

By C. A. VANDERMUELEN.

[Reprinted from Sci. Am., May 6, 1916, pp. 470 and 495.]

NOTE.—The following account draws attention to a striking effect of the slowness with which the annual temperature wave goes into the ground.—ED.

"It was discovered some 18 years ago by a farmer who, noting a peculiar coldness—even in the warmest weather—of a certain portion of his farm, was led to dig there in the belief that he would find a deposit of silver. [Near Coudersport, Pa.] The mine or cave which he unearthed proved to be 40 feet deep and from 10 to 12 feet in diameter. At present it is entered by